

20 April 1960

MEMORANDUM FOR: Office of Logistics/Procurement Division/Contract Branch

SUBJECT: Request for Change in Scope and Additional Funds under Task 16 of Contract DD-138 [redacted] 25X1

1. Task 16 under Contract DD-138 was established in May 1959 for the test and evaluation of the new Latching Radio Switch System (LRS-1). This program proceeded until a basic weakness in the equipment made it necessary to return the equipment to the manufacturer for modification. It is now desired that this modified equipment be evaluated and tested in accordance with the contractor's proposal attached hereto. It is therefore requested that the scope of Task 16 be amended to provide for test and evaluation of the modified LRS system in order to obtain sufficient data to permit appraisal of performance, suitability, and reliability of the system.

2. Additional funds in the amount of \$9,155.00 are to be made available to the contractor for the performance of this work. Charges are to be made against Allotment Number 0785-1009-4901.

3. It is further requested that the expiration date of Task 16 be extended from 4 July 1960 until 31 August 1961.

4. Additional information concerning this request may be obtained by contacting the project engineer for this program, [redacted] Room #10, West Outbuilding, [redacted] 25X1
25X1

[redacted]
Chief
TED/Engineering Branch

Attachments:

Proposal dated 21 Apr 1960
TED-913-87- 1960-60

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APPROVED FOR THE OBLIGATION OF FUNDS:

Research Director

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Date

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ED/P/TED/LS/PT

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SUBJECT: Proposal for LRS Evaluation, Phase II

Reference: Contract ED-132, Task Order No. 16

Enclosure: Technical Description dtd 5 April 1960, by 
serial: 116-46-3

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Dear 

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We are pleased to submit this quotation for Phase II of the LRS Evaluation in reply to your recent request.


The objective of this proposed program is to obtain, through test and observation, sufficient data to permit appraisal of performance, suitability, and reliability of the LRS system. A secondary objective is the generation of conclusions and recommendations derived from test results which may improve the usefulness of the equipment. The technical details and further discussion are contained in the enclosed "Technical Description."

It is estimated that this program, including a final report to be furnished in nine (9) months, and a life-test supplement in six (6) months, can be completed in fifteen (15) months from date of contract acceptance.


The estimated cost of this program is as follows in the Cost Breakdown.

COST BREAKDOWN


Estimated Cost - Phase II

Engineering Direct Labor
ILE at 
Material

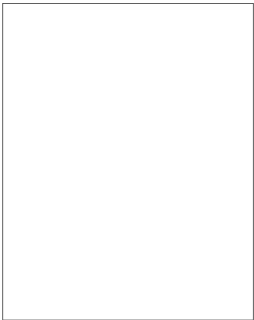
Sub-Total

G&A at 

Sub-Total Cost

Fee at 

Total Cost + Fee \$ 16,892



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As Phase I was abruptly terminated because of technical deficiencies of the equipment being tested, we have remaining sums of authorized funds available to apply to Phase II, if it should be granted as an extension of the present contract. The cost breakdown, using the remaining funds, would then be as follows:

COST BREAKDOWNEstimated Cost Phase II, Using Remaining Authorized Funds of Phase I

Phase II, Estimated Cost (Engrg)
Less Unexpended Balance (Ph. I)

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Engineering Funds Required (Ph. II)

G&A at
Less Unexpended Bal. (Ph. I) 132

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G&A Funds Required (Ph. II)

Cost + G&A Funds Required (Ph. II)

Fee at
Less Unexpended Bal (Ph. I) 619

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Fee required (Ph. II) \$ 733

TOTAL COST PLUS FEE REQUIRED PH. II \$ 9,155

Very truly yours,

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Prepared by:

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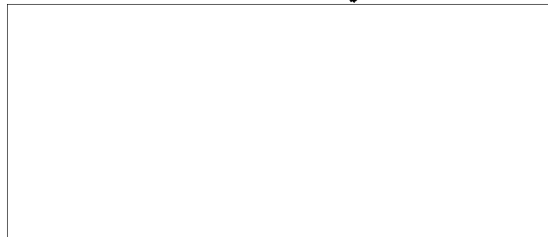
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**Proposal for
LRS Evaluation, Phase II
(Contract U.S.-132, Task 16)**

TECHNICAL DESCRIPTION

5 April 1960

Authored By:



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Copy No. 3**LRS EVALUATION****PHASE II****Purpose:**

The objective of this proposed program is to obtain, through test and observation, sufficient data to permit appraisal of performance, suitability, and reliability of the LRS system. A secondary objective is the generation of conclusions and recommendations derived from test results which may improve the usefulness of the equipment.

A previous program was started and proceeded long enough to uncover a basic equipment weakness. The equipment was withdrawn from test by the customer and sent to the manufacturer for modification. The present program is designed to evaluate the modified equipment along the general lines proposed for the original equipment. Certain modifications in the test procedure are included where experience with the equipment has indicated the feasibility or desirability of certain tests. Other tests were found to be impractical or meaningless and have been excluded.

A final report will be issued at the end of the regular test program and a supplement will be issued at the conclusion of the life-testing program.

Discussion:

The program outlined in this proposal will be divided into three general categories: laboratory tests, field tests, and life tests. The laboratory tests include all tests and measurements of equipment characteristics which can be compared directly with similar measurements on other apparatus. Laboratory tests will be made under controlled conditions using techniques and instrumentation which may be duplicated at any time. Laboratory test results provide the fundamental data upon which an evaluation can be made. Field tests are composed of measurements made under simulated field conditions to provide some indication of expected performance in actual use. In general, field test results are not duplicable and cannot provide a sound basis for objective evaluation. Field tests and results, when specified and interpreted by the user, can provide valuable information relating to improved application. Life test results provide indications of expected life and deterioration with age. Since it is not possible to test a statistically adequate sampling of equipments and environments in the program, test results cannot be considered conclusive. Throughout the entire test period, the equipment and instruction material will be subject to critical observation and subjective appraisal. Such observations will cover the areas of operation, installation, maintenance, general handling precautions, and improved design.

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For the tests enumerated and described below, at least five transmitters and ten receivers will be required. Two transmitters and four associated receivers will be placed on life test, and an equal number will be used for the laboratory and field portions of the testing. The remaining set, consisting of one transmitter and two receivers, will be retained as spares in the event of failure of any of the equipment undergoing test.

Testing Program:

While it is beyond the scope of this proposal to describe in detail the tests to be performed, the following listing will give an indication of the general areas of investigation. Included are those tests specifically required by the Customer. In addition, experience gained in the partial performance of the test program on the earlier equipment has been used as a guide in the determination of the most desirable and informative tests to be performed here.

I. Laboratory Tests:

- A. Receiver Measurements: Measurements will be made on receivers in the condition received. One receiver will be aligned and partially rechecked.

Should a substantial difference be noted, all receivers will be re-aligned and re-tested.

Wherever possible, receiver measurements will be made using a CW signal from a precision signal generator. Where pulsed signals are required, the signal generator output will be suitably modulated. Receiver input measurements will be made at the antenna terminals as determined by calibrated signal generator output. Receiver output measurements will be made at the detector output.

Certain measurements will be considered "standard" or "repeated" tests which will be made at regular intervals to determine the general condition of the equipment as the testing progresses. These tests will be the ones performed on the life test units and as such are calculated to give the best indication of deterioration of the equipment with age.

1. Repeated Tests:

- a. Sensitivity: Measure the input voltage required to produce a nominal signal (-1 volt DC) at the Detector.

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- b. Trigger level: Vary the input voltage and measure the detector voltage at the level where consistent triggering occurs.
 - c. Pulse length: Measure the shortest and longest input pulses which will just cause consistent triggering. Keep input level sufficient to saturate the detector.
- 2. Measure the detector output as a function of input frequency with a CW signal sufficient to saturate the detector. Determine the center or peak frequency, and measure the bandwidth between 3 db points.
 - 3. Dynamic range: For a CW signal input at the center frequency, determine the relationship between input signal level and DC voltage at the detector output.
 - 4. Relay drive voltage: Determine adequacy of output multivibrator in the receiver to drive the relay.
 - 5. Relay contact resistance: Measure the relay contact resistance for several current values within the contact rating of the relay. Both AC and DC will be used.
 - 6. Power source variations: Vary the AC voltage to the power supply from 0 to at least 125 volts AC. Measure the following:
 - a. Power consumption of power supply.
 - b. Current drawn by the receiver.
 - c. DC output voltage of the power supply.
 - d. Center frequency and bandwidth of RF section.
 - e. Sensitivity as defined in Para. 1a.
 - f. Trigger level as defined in Para. 1b.
 - g. Pulse length as defined in Para. 1c.
 - 7. Temperature and humidity: Vary the temperature and humidity from 0°C at 0% to 100% relative humidity to 60°C at 95% to 100% relative humidity and make the measurements detailed under power source variations, paragraph 6 above, with the exception of Item 6.d.

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- B. Transmitter Measurements:** Measurements will be made on two transmitters tuned in accordance with the instruction book. Measurements will be made using CW operation of the transmitter, except where necessary.

As was the case with the receivers, certain tests will be repeated at intervals to determine the deterioration of the equipment as the testing progresses. These tests will be the ones performed at intervals on the life test equipment.

1. Repeated Tests:

- a. **Power output:** Power output will be determined by measuring voltage across a dummy load for optimum tuning of the equipment.
 - b. **Pulse Calibration:** Measure the actual pulse width with the pulse width control set at 10 milliseconds and again at 20 milliseconds.
 - c. **Observe the meter readings in the "Oscillator Tune" and in the "Amplifier Tune" positions with optimum tuning.**
 - d. **Input Power:** Measure the input power in both the "key up" and "key down" conditions.
 - e. **Start-up line voltage:** Determine the AC input voltage at which an RF output can first be detected.
- 2. Frequency:** Determine the operating frequency with the equipment tuned as directed by the instruction book.
- 3. Pulse width calibration:** Determine the actual pulse width as a function of the position of the pulse width control.
- 4. Line voltage matching tests:** Determine the line voltages which can be matched by the control on the front panel of the transmitter.
- 5. Antenna matching efficiency:** Determine the range of the antenna matching network and the effect on RF output of loads outside of the optimum region.

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6. Power source variations: Vary the AC voltage to the unit from 0 to at least 125 volts AC. Measure the following:
 - a. Power consumption.
 - b. RF center frequency.
 - c. Power output.
 - d. Pulse width obtainable at extreme setting of the control.
7. Temperature and humidity: Vary the temperature and humidity from 0°C at 0% to 10% relative humidity to 50°C at 99% to 100% relative humidity and make the measurements detailed under power source variations, paragraph 6 above.
8. Spurious Outputs: Examine the transmitter output for evidence of spurious outputs such as parasitics, harmonics or sub-harmonics.

II. Field Tests:

A. Receiver Measurements:

1. Antenna tests: With a fixed RF field strength at the receiving antenna, measure detector voltage while changing the following parameters.
 - a. Receiving antenna length.
 - b. Number of auxiliary antennas coupled to the receiving antenna.
 - c. Polarization of both transmitting and receiving antennas from horizontal to vertical.
2. Irregular operation: Attempt to obtain false triggering of the receiver by employing random signals, and by switching of equipment associated with the receiver.
3. Altitude: One unit will be subjected to a pressure of 2.5 psi, corresponding to an altitude of 40,000 feet, for a period of one hour. Operation will be checked upon return to ambient conditions.

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5. **Vibration:** One unit will be subjected to vibration in a manner to be specified by the customer. Operation of the equipment will be checked both during and after vibration.

b. **Drop:** One unit will be dropped in a manner to be specified by the customer. Operation of the equipment will be checked after the drop, and a detailed examination for damage will be made.

B. Transmitter Measurements:

1. **Antenna tests:** Field intensity will be measured at fixed range and antenna height for various antenna lengths. Both vertical and horizontal polarization will be employed. An external matching network will be used to determine efficiency of the transmitter matching network.

2. **Altitude:** One unit will be subjected to a pressure of 2.5 psi, corresponding to an altitude of 40,000 feet, for one hour. Operation of the equipment will be checked after return to ambient conditions.

3. **Temperature:** One unit will be subjected to a temperature of -65°F for a period of two hours. Operation of the equipment will be checked after return to ambient conditions.

4. **Vibration:** One unit will be subjected to vibration in a manner to be specified by the customer. Operation will be checked both during and after vibration. A check will be made to determine the extent and nature of any damage to the equipment.

C. **System Operation:** Field tests of the entire system will be made under several simulated "typical" installations. Both fixed and mobile transmitter locations will be used. An attempt will be made to generate guidelines for optimum operation of the equipment, though it must be realized that each installation presents different problems.

III. Life Tests:

A. **Receiver Relays:** Receiver relays will be placed in a test fixture which causes them to be operated twice each minute, 24 hours per day. A counter will be

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attached to the load circuit to determine when failure occurs. Contacts will be loaded to full rated current, with filtering. Operation will be checked several times daily. Testing will continue until failure of the relay. Several relays will be tested.

- B. LRS System Life Test: Because the equipment must operate as a system, life performance will be checked in this manner. The receivers will be placed in insulated containers to raise ambient temperature to levels which might be expected in normal installation. The receivers will be run on a continuous basis. Transmitters will be turned on for two eight-hour periods daily. During the "on" periods, the transmitters will be triggered one each hour. Counters will monitor receiver switching in response to this triggering. Operation will be monitored daily. When a piece of equipment fails, it will be repaired or replaced up to the limit of available spare equipment. Life testing will continue for one calendar year or until all equipment has failed, whichever is shorter. At intervals, the "repeated" tests (described under the laboratory test section) will be performed, to determine the deterioration of the equipment with age. Two transmitters and four receivers will be tested. Two receivers will be run from battery supplies, if furnished by the customer.

IV. Observations: Throughout the test program, the equipment will be observed specifically for information regarding the following:

- A. Reliability in use and general structural ruggedness.
- B. Vulnerability to damage, due to mishandling or wrong connections.
- C. Detectability as caused by audible noise, sensible heat, or spurious radiations.
- D. Irregular operation of relays, particularly with respect to undesired actuation, rather than failure to actuate.
- E. Installation notes which may make for improved field operation.
- F. Apparent adequacy of the instruction book.

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